

MRes in Nuclear Energy [1+3]

This document provides a definitive record of the main features of the programme and the learning outcomes that a typical student may reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities provided. This programme specification is primarily intended as a reference point for academic and support staff involved in delivering the programme and enabling student development and achievement, for its assessment by internal and external examiners, and in subsequent monitoring and review.

Programme Information

Award	MRes			
Programme Title	Nuclear Energy			
Programme code	H8NE			
Awarding Institution	Imperial College London			
Teaching Institution	Imperial College London			
Faculty	Faculty of Engineering			
Department	Department of Materials			
Mode and Period of Study	1 year full-time (12 months)			
Cohort Entry Points	Annually in October			
Relevant QAA Benchmark Statement(s) and/or other external reference points	Engineering			
Total Credits	ECTS:	90	CATS:	180
FHEQ Level	Level 7 - Master's			
EHEA Level	2 nd cycle			
External Accreditor(s)	None			
Specification Details				
Student cohorts covered by specification	2015/16			
Responsible Officer	Professor William Lee			
Date of introduction of programme	October 2015			
Date of programme specification/revision	March 2015			

Description of Programme

The programme takes a broad whole systems approach to nuclear energy, covering all aspects from design and build, through operation to decommissioning and final disposal. The programme is both taught and research based.

The programme objectives are to:

- Educate a new generation of engineers equipped with specific nuclear training that will be in demand by the nuclear industry in the UK and abroad.
- Offer students the opportunity to gain industrial experience in the nuclear industry.
- Train students within the 1+3 CDT programme and enable transfer of skills and talent from relevant subject areas.

The MRes is only offered as part of a 1+3 programme in the ICO CDT in Nuclear Energy.

Alignment with College Strategy

The programme objectives are to:

- Attract high quality strongly motivated students from the UK.
- Generate students capable of research which maintains Imperial College's status amongst the top tier of research institutions of national and international importance.

Learning Outcomes

Knowledge and Understanding:

- Reactor systems: construction, operation, monitoring and safety systems.
- Fuel cycle: from mining, conversion, enrichment, fabrication and performance to spent fuel storage.
- Reactor physics and control: neutronics, nuclear reactions and reactor dynamics.
- Materials performance: radiation damage, radiation effects, ageing, corrosion and mitigation.
- Nuclear safety management
- Nuclear waste: reprocessing, waste form synthesis and performance and decommissioning, decontamination, transport of radiotoxic species and geological disposal.
- Radiation protection: shielding, dose and biological effects.
- Nuclear accidents: component failure, operation errors, consequences and mitigation.
- Experience of reactor working environment through a reactor site visit
- Appreciation of the current position of the UK nuclear industry with a national and international perspective

Intellectual Skills:

- Synthesis of knowledge to solve a practical problem.
- Analysis of a problem leading to an optimal solution strategy.
- Evaluation of long term consequences of actions taken.
- The ability to learn new theories, concepts, methods, etc., in unfamiliar situations.

Practical Skills

- Computer modelling applied to nuclear systems: from atomic scale to continuum scales, including structural mechanics, fluid flow and heat transfer.
- Solving numerical problems of value to the nuclear industry.

- Retrieval and critique of information from the nuclear literature.
- Use of databases and bibliographic software programmes.
- Report writing for a nuclear industrial audience.
- Preparation of a safety case.
- Radiological hazard assessment.
- Nuclear accident scenarios and planning.
- Data Analysis.

Transferable Skills

- The ability to analyse and think through problems both independently and as part of a group.
- An understanding of different roles within a team, and the ability to exercise leadership.
- Develop initiative and communication skills through peer group working and research projects.
- The ability to monitor and adjust a personal programme of work on an on-going basis.
- Presentation skills.
- Literature review and critique.
- Report writing.

Entry Requirements

Applicants to the MRes will apply for the Integrated MRes/PhD 1+3 Programme in the ICO CDT in Nuclear Energy. Applicants must select a research area and supervisor for their intended PhD research project.

Academic Requirement	Normally a UK Bachelor's Degree at 2:1 (or equivalent) in Mechanical Engineering, Chemical Engineering, Civil Engineering, Physics, Chemistry or Materials Science
Additional Requirements	None
English Requirement	IELTS 6.5 with no element below 6.0 (or equivalent)

Applicants will be invited to attend an interview for entry to the MRes. Where an applicant has indicated a preferred PhD supervisor at a partner institution in the ICO CDT this interview will be carried out by the relevant institution; either Cambridge or the Open University as appropriate.

Learning & Teaching Strategy

Scheduled Learning & Teaching Methods	<ul style="list-style-type: none"> • lectures • workshops
E-learning & Blended Learning Methods	<ul style="list-style-type: none"> • On-line module information
Project and Placement Learning Methods	<ul style="list-style-type: none"> • Visits to TRIGA (Romania) and Halden (Norway) Reactors • Individual Research Project

Assessment Strategy					
Assessment Methods		<ul style="list-style-type: none"> • Written examination • Coursework • Dissertation • Presentation 			
Academic Feedback Policy					
Students can expect to receive feedback within two weeks.					
Re-sit Policy					
Students will be permitted to re-sit a failed assessment (including re-submission of a failed piece of coursework) on a single occasion. Examination re-sits will be available at the next available sitting, normally the following academic year.					
Mitigating Circumstances Policy					
The programme will follow the procedures for mitigating circumstances as described in the College Regulations and in the mitigating circumstances procedure. Details of which can be found at: http://www3.imperial.ac.uk/registry/proceduresandregulations/policiesandprocedures/examinationassessment					
Programme Structure					
Full-time	Pre-session	Term One	Term Two	Term Three	Term Four (summer)
Core Modules	0	3	3	0	0
Core Short Courses	0	0	2	0	0
Project	0	0	1		
Assessment Dates & Deadlines					
Written Examinations		Summer term			
Coursework Assessments		Continuous			
Project Deadline		15 th September			
Practical Assessments		Late-September (normally two weeks after submission of the thesis)			

Assessment Structure	
Module	% Module Weighting
Introduction to Nuclear Energy	5.25%
Reactor Physics	5.25%
Nuclear Materials 1: Materials for Reactor Systems	5.25%
Nuclear Materials 2: Nuclear Waste Management and Decommissioning	5.25%
Modelling for Nuclear Engineers	5.25%
Nuclear Safety Management	5.25%
Nuclear Energy Policy	5.25%
Nuclear Engineer in Industry	5.25%
Nuclear Energy Research Project	58%
Rules of Progression	
Not applicable – 1 year full-time programme	
Marking Scheme	
<p>For the taught component Students must pass five modules from:</p> <ul style="list-style-type: none"> • Introduction to Nuclear Energy • Reactor Physics • Nuclear Materials 1: Materials for Reactor Systems • Nuclear Materials 2: Nuclear Waste Management and Decommissioning • Modelling for Nuclear Engineers • Nuclear Safety Management <p>And at least one module from</p> <ul style="list-style-type: none"> • Nuclear Energy Policy • Nuclear Engineer in Industry <p>For the research component students must pass:</p> <ul style="list-style-type: none"> • Nuclear Energy Research Project <p>The pass mark for each component is 50%.</p> <p>The pass mark for each module is 50%. A module with a mark of less than 45% will not be condoned and the student must therefore re-sit or re-submit any failed assessments for the relevant module.</p> <p>The pass mark for each assessment is 50%. An assessment with a mark of less than 40% will not be condoned and the student must therefore re-sit or re-submit the relevant assessment.</p> <p>Classifications</p> <p>Pass - a student must achieve an aggregate mark of 50% in each programme component</p>	

Merit – a student must achieve an aggregate mark of 60% in each programme component
Distinction – a student must achieve an aggregate mark of 70% in each programme component

Acceptance on PhD Programme

Students who successfully complete the MRes at the first attempt will be accepted on to the PhD Programme of the Integrated MRes/PhD 1+3 Programme in the ICO CDT in Nuclear Energy. Students who are required to re-sit assessments for the MRes will not normally be accepted.

Module List												
Code	Title	Core/ Elective	Year	L&T Hours	Ind. Study Hours	Place- ment Hours	Total Hours	% Written Exam	% Course- work	% Practical	FHEQ Level	ECTS
MSE4-INE	Introduction to Nuclear Energy	Core	1	20	130	0	150	50%	50%	0%	7	6
ME4-MNURP	Reactor Physics	Core	1	24	126	0	150	100%	0%	0%	7	6
MSE 414	Nuclear Materials 1: Materials for Reactor Systems	Core	1	20	130	0	150	100%	0%	0%	7	6
MSE 419	Nuclear Materials 2: Nuclear Waste Management and Decommissioning	Core	1	24	126	0	150	100%	0%	0%	7	6
MSE4-MNE	Modelling for Nuclear Engineers	Core	1	27	123	0	150	0%	100%	0%	7	6
MSE4-NSM	Nuclear Safety Management	Core	1	24	126	0	150	75%	25%	0%	7	6
MSE 9NC5	Nuclear Energy Policy	Core	1	12	63	0	75	0%	100%	0%	7	3
MSE 9NC4	Nuclear Engineer in Industry	Core	1	12	63	0	75	0%	100%	0%	7	3
MSE.N.RRP	Nuclear Energy Research Project	Core	1	0	1200	0	1200	0%	95%	5%	7	48

Supporting Information

The Programme Handbook is available via Blackboard

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The programme's competency standards documents can be found at:

<http://www.imperial.ac.uk/engineering/departments/materials/>

The College's entry requirements for postgraduate programmes can be found at:

<http://www3.imperial.ac.uk/entryrequirements/graduate>

Details of the College's pastoral care and welfare support is available at:

<http://www.imperial.ac.uk/students/student-support/>

Details of Departmental arrangements for pastoral care and welfare support is available at:

<http://www.imperial.ac.uk/engineering/departments/materials/>

The College's Quality & Enhancement Framework is available at:

<http://www3.imperial.ac.uk/registry/proceduresandregulations/qualityassurance>

The programme is consistent with the Qualifications Framework of the European Higher Education Area which is available at:

<http://www.ehea.info/Uploads/qualification/QF-EHEA-May2005.pdf>